

FIGURE 5 illustrates the ultrasonic cleaning apparatus of Figure 1 and associated pump and filtration equipment used in accordance with an embodiment of the invention.

FIGURES 6(a)-6(c) illustrates the process of positioning a fuel assembly within the housing of the invention.

FIGURE 7 illustrates an embodiment of the invention using diagonally positioned ultrasonic transducers.

FIGURES 8(a)-8(b) illustrate a mobile ultrasonic cleaning apparatus in accordance with an embodiment of the invention.

FIGURE 9 illustrates the ultrasonic cleaning apparatus of the invention with an integral pump and filtration system.

FIGURES 10-13 illustrate an ultrasonic cleaning apparatus for use in connection with Boiling Water Reactors.

Like reference numerals refer to corresponding parts throughout the drawings.

DETAILED DESCRIPTION OF THE INVENTION

Figure 1 is a front view of an ultrasonic cleaning apparatus 20 constructed in accordance with an embodiment of the invention. The apparatus 20 includes ultrasonic transducers 22 mounted on a housing 24. A guide 28 is positioned at the top of the housing 24. A nuclear fuel assembly (not shown in Figure 1) is passed through the guide 28 and into the housing 24. Once the nuclear fuel assembly is positioned within the housing 24, it is cleaned through the application of ultrasonic energy from the ultrasonic transducers 22, as discussed further below.

Assembly reaction supports 26 may be used to mount the housing 24 to a wall of a cleaning pool. Alternately, the housing 24 may be supported by a crane or hoist. Figure 1 also illustrates filtration piping 32 and an emergency cooling hole 30, for use in the event that the filtration system fails. The emergency cooling hole 30 provides sufficient decay heat removal from the fuel channel through natural convection in the event of equipment failure (e.g., loss of pumps). Filtration piping 32 is used to send water laden with removed deposits to a filtration unit, as discussed below.

The transducers 22 may be mounted on transducer mounting plates 34. The transducer mounting plates 34 are used to connect the transducers 22 to the housing